

What is claimed is:

1. A method of localizing a medical device inside a patient's body, the method comprising:

transmitting ac magnetic signals between multiple pairs of points, one point of each pair at a known location outside of the patient's body and one point of each pair on the medical device inside the patient's body, the signals transmitted between at least some of the pairs of points comprising at least two different frequencies;

receiving the transmitted ac magnetic signals and processing the received signals to determine the position of the points on the medical device, and thus the location of the medical device, this processing including correcting for the affects of metal in the vicinity by using the transmitted and received signals at different frequencies.

2. The method according to claim 1 wherein the signals comprising at least two different frequencies are modulated signals.

3. The method according to claim 2 wherein the modulated signals are amplitude modulated signals.

4. The method according to claim 2 wherein the modulated signals are frequency modulated signals.

5. The method according to claim 1 wherein the signals comprising at least two different frequencies are multiplexed signals of at least two different frequencies.

6. The method according to claim 1 wherein the signals are transmitted from the points outside the body

7. The method according to claim 6 wherein each point transmits a different signal.

8. The method according to claim 1 wherein the signals are transmitted from the points inside the body.

9. The method according to claim 8 wherein and each point transmits a different signal.

10. In a method of localizing a medical device inside a patient's body by transmitting ac magnetic signals between multiple pairs of points, one point in each pair being at a known location outside of the patient's body and one point of each pair being on the medical device inside the patient's body, and processing the signals received to determine the location of medical device, the improvement comprising transmitting signals of at least two different frequencies between at least some of the pairs of points and correcting for inaccuracies in determined location that would be caused by presence of metal by using the differential frequency response.

11. A method of localizing a medical device inside a patient's body by transmitting an ac magnetic signal comprising at least two frequencies between multiple pairs of points, one point of each pair being at known location outside of the patient's body, and one point of each pair being on the medical device inside the patient's body, and processing the received signals at at least two frequencies to determine the position of the medical device.

12. The method according to claim 11 wherein the signals comprising at least two different frequencies are modulated signals.

13. The method according to claim 12 wherein the modulated signals are amplitude modulated signals.

14. The method according to claim 12 wherein the modulated signals are frequency modulated signals.

15. The method according to claim 11 wherein the signals comprising at least two different frequencies are multiplexed signals of at least two different frequencies.

16. The method according to claim 11 wherein the signals are transmitted from the points outside the body

17. The method according to claim 16 wherein each point transmits a different signal.

18. The method according to claim 11 wherein the signals are transmitted from the points inside the body.

19. The method according to claim 18 wherein and each point transmits a different signal.

20. A method of localizing a medical device in a patient's body during a medical procedure, the method comprising:

securing a reference catheter near the procedure site in the patients' body;

introducing the medical device into the patient's body;

transmitting signals comprising at least two frequencies between the device and the reference catheter and processing the signals to determine the position of the device relative to the reference catheter.

21. The method according to claim 20 the signals are transmitted by the reference catheter and received by the device.

22. The method according to claim 20 wherein the signals are transmitted by the device and received by the reference catheter.

23. The method according to claim 20 wherein signals are both transmitted and received by the reference catheter and the instrument.

24. A method of localizing a medical device at a procedure site in the body, comprising:

securing a reference catheter near the procedure side in the patient's body;

transmitting signals comprising at least two frequencies between the reference catheter and at least one reference device of known position in an external frame of reference outside the body to determine the position of the reference catheter with respect to the external frame of reference;

introducing the medical device into the patient's body;

transmitting signals between the medical device and the reference catheter and processing the signals to determine the position of the device relative to the reference catheter;

determining the position of the medical device relative to the external reference frame.

25. The method according to claim 24 wherein the signals are transmitted by the reference catheter and received by the reference device.

26. The method according to claim 24 wherein the signals are transmitted by the reference device and received by the reference catheter.

27. The method according to claim 24 wherein signals are both transmitted and received by the reference catheter and the reference device.

28. The method according to claim 24 wherein signals are transmitted by the reference catheter to the medical device.

29. The method according to claim 24 wherein signals are transmitted by the medical device to the reference catheter.

30. The method according to claim 24 wherein at least some of the signals transmitted between the reference catheter and the medical device comprise at least two frequencies.

31. The method according to claim 24 wherein signals are transmitted from the at least one reference device to the reference catheter, and wherein signals are transmitted from the medical device to the reference catheter.

32. The method according to claim 24 wherein signals are transmitted from the reference catheter to the at least one reference device, and wherein the signals are transmitted from the reference catheter to the medical device.

33. The method according to claim 24 wherein signals are transmitted from the at least one reference device to the reference catheter, and wherein the signals are transmitted from the reference catheter to the medical device.

34. The method according to claim 21 wherein signals are transmitted from the reference catheter to the at least one reference device, and wherein the signals are transmitted from the from the medical device to the reference catheter.

35. A method of visualizing a medical device during a medical procedure in a patient's body, the method comprising:

securing a reference catheter near the procedure site in the patients' body;

making a pre-procedure image of the procedure site including the reference catheter;

introducing the medical device into the patient's body;

transmitting signals between the instrument and the reference catheter and processing the signals to determine the position of the instrument relative to the reference catheter;

displaying the pre-procedure image with an image of the medical device superposed thereon based on the determined position of the medical device to the reference catheter.

36. The method according to claim 35 wherein the signals transmitted are at least one of ultrasonic, ac magnetic or dc magnetic.

37. The method according to claim 35 wherein the signals are transmitted by the reference catheter and received by the medical device.

38. The method according to claim 35 wherein the signals are transmitted by the medical device and received by the reference catheter.

39. The method according to claim 35 wherein signals are both transmitted and received by the reference catheter and the medical device.

40. A method of localizing a medical device at a procedure site in the body, comprising:

securing a reference catheter near the procedure side in the patient's body;

transmitting signals between the reference catheter and at least one reference device of known position in an external frame of reference outside the body to determine the position of the reference catheter with respect to the frame of reference;

introducing a medical device into the patient's body;

transmitting signals between the medical device and the reference catheter and processing the signals to determine the position of the medical device relative to the reference catheter;

determining the position of the medical device relative to the external reference frame.

41. The method according to claim 40 wherein the signals transmitted are at least one of ultrasonic, ac magnetic or dc magnetic.

42. The method according to claim 40 wherein the signals are transmitted by the reference catheter and received by the medical device.

43. The method according to claim 40 wherein the signals are transmitted by the medical device and received by the reference catheter.

44. The method according to claim 40 wherein signals are both transmitted and received by the reference catheter and the medical device.

45. The method according to claim 40 wherein signals are transmitted from the at least one reference device to the reference catheter, and wherein the signals are transmitted from the medical device to the reference catheter.

46. The method according to claim 40 wherein signals are transmitted from the reference catheter to the at least one reference device, and wherein the signals are transmitted from the medical device to the reference catheter.

47. The method according to claim 40 wherein signals are transmitted from the at least one reference device to the reference catheter, and wherein the signals are transmitted from the reference catheter to the medical device.

48. The method according to claim 40 wherein signals are transmitted from the reference catheter to the at least one reference device, and wherein the signals are transmitted from the reference catheter to the medical device.